

REMARKS/ARGUMENTS

Reconsideration of the above-identified application in view of the present amendment is respectfully requested. Claims 1-8, 12-21, and 24-36 are pending.

Rejections under 35 U.S.C. §103

Claims 1-4, 13-15, 20-21, 25-26 and 29-30 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 7,268,866 to Messler (hereafter "Messler") in view of U.S. Patent No. 6,177,649 to Juret et al. (hereafter "Juret"). That rejection is respectfully traversed.

Claim 1 recites the step of obtaining a thermal image as a weld is being formed by collecting infrared radiation passing through a second piece of material from the weld and a pool of material.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). The combination of Messler and Juret does not teach the subject matter of claim 1.

Messler teaches that a pyrometer 58 detects the thermal radiation 60 emitted by the weld at the melt 48, i.e. the unsolidified portion of the weld seam 15 (Fig. 6). The solidified weld seam 15 is inspected by inspection radiation 30, whose exit radiation 33, 33' from an inspection point 57 on the weld 15 is detected by a detector 55 (Col. 7, lines 1-3 and Fig. 2). The inspection point 57 is located at a well-defined distance 51 from the focus 47 of the heating laser beam 20, which is the area in which the melt 48 forms between the materials 18, 19 (Col. 6, lines 26-30 and 35-

36). The inspection radiation 30 is completely independent of the thermal radiation emanating from the weld (Col. 5, lines 36-38).

It is clear from the above that the detector 55 inspects only the solidified weld seam 15 and the pyrometer 58 inspects only the unsolidified melt 48. Thermal radiation is therefore used only for inspecting the melt 48 and not the finished weld seam 15. Accordingly, Messler does not teach obtaining a thermal image as a weld is being formed by collecting infrared radiation passing through a second piece of material from the weld and a pool of material.

Juret does not cure the deficiencies of Messler. Juret is related to an IR camera 6 that is designed to provide thermal images of certain locations in relation to the fusion zone of two metal plates being welded together end-to-end. The Examiner asserts (Office Action page 9) that Juret teaches that it is very well known in the art to use an IR camera to indicate a thermal profile of a weld prior, during and after welding (Col. 1, lines 24-31). This profile, however, is not directed at a weld and a pool of material. Rather, an IR camera 6 may observe a zone disposed immediately ahead of the advancing fusion zone, or a zone providing a thermal image at the fused metal, or a zone behind the advancing fusion zone (Col. 5, lines 6-13 and Fig. 2A). None of these zones capture thermal images of a weld and a pool of material, as recited in claim 1. Thus, Juret does not cure the deficiencies of Messler. Since the combination of Messler and Juret does not teach the subject matter of claim 1, it is respectfully submitted that claim 1 patentably defines over the combination of Messler and Juret and is therefore allowable.

Claim 2 recites the step of obtaining a thermal image that includes, in its entirety, a weld pool that results in a weld. Neither Messler nor Juret taken either alone or in combination disclose or suggest this feature. In Messler, the pyrometer 58 detects only the thermal radiation of a portion of the melt 48 and not an entire weld pool that results in a weld.

Juret does not cure the deficiencies of Messler. As noted, the profile of the IR camera 6 in Juret includes only the fused metal and is not configured to have a field of view which includes a weld pool. Thus, Juret does not teach obtaining a thermal image that includes, in its entirety, a weld pool that results in a weld. Since the combination of Messler and Juret does not teach the subject matter of claim 2, it is respectfully submitted that claim 2 patentably defines over the combination of Messler and Juret and is therefore allowable.

Claim 3 recites the step of positioning an infrared detector in a location in which a weld pool in its entirety is within a field of view of the infrared detector. As noted, the combination of Messler and Juret does not teach imaging a weld pool in its entirety. Thus, the combination of Messler and Juret does not teach positioning an infrared detector in a location in which a weld pool in its entirety is within a field of view of an infrared detector. Since the combination of Messler and Juret does not teach the subject matter of claim 3, it is respectfully submitted that claim 3 patentably defines over the combination of Messler and Juret and is therefore allowable.

Claim 4 depends from claim 1 and is allowable for at least the same reasons as claim 1 and for the specific limitations recited therein.

Claim 13 recites the step of heating first and second plastic pieces by directing a laser beam over a path of weld pool multiple times to form a pool of material. Simultaneously with the heating step, a thermal image is obtained as a weld is being formed between the first plastic piece and the second plastic piece, which is transmissive to the laser beam, by collecting infrared radiation within the determined range of wavelengths from the weld and the pool of material. The combination of Messler and Juret does not disclose or suggest this subject matter.

The Examiner acknowledges that Messler does not teach heating first and second plastic pieces at their location of abutment by directing the laser beam over the path of a weld pool multiple times. The Examiner asserts, however, that it is inherent "that the weld should be heated by the laser beam a plurality of times in order to create a weld having a desired length".

Under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to include the missing element if the missing element is "necessarily present" in the item described in the reference.

Continental Can Co. v. Monsanto Co., 948 F.2d 1264, 1268 (Fed. Cir. 1991).

"Necessarily present" for inherency means more than merely probably or possibly present. Trintec Industries, Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1295 (Fed. Cir. 2002).

Claim 13 does not recite that the weld is heated by the laser beam a plurality of times at a plurality of points in order to create a weld having a desired length. Rather, claim 13 specifically recites directing the laser beam over the path of a weld pool multiple times. This recitation is clearly supported in the specification. In

particular, it is disclosed that the beam 50 of electromagnetic energy may start in the upper, right corner of the weld pool 60 (Fig. 2) and may be moved around the generally square-shaped path in a clockwise direction multiple times (Page 11, lines 5-9). Thus, the beam 50 is directed over the same points on the path multiple times. This beam directing is not equivalent to prolonged beam directing or beam directing at a plurality of points as the Examiner asserts (Office Action pages 3 and 11).

For these reasons, this feature of claim 13 is not "necessarily present" in Messler. In fact, Messler specifically teaches **not** directing the laser beam over the path of a weld pool multiple times. In particular, Messler specifically discloses that for the first method of Fig. 2, a laser beam 20 strikes two movable beam-deflecting mirrors 23, 24, which direct the laser beam to the workpiece 10 through a theta objective 35 to produce the weld seam 15 by simultaneous welding (Col. 4, lines 9-16). Messler specifically discloses that the laser beam 20 enters a processing head 50 and is collimated by a lens 45 in the method of Fig. 6. The beam then passes through two mirrors 43, 44 and is bundled by a collimator 46 and focused on a well-defined area 47 of the workpiece 10 (Col. 6, lines 14-17). A melt 48 of both materials 18, 19 forms in the area of the focus 47. During movement of the workpiece 10 relative to the processing head 50, the focus moves along the workpiece, and the melt gradually undergoes solidification 49. The weld seam 15 forms in this way. (Col. 6, lines 26-31). Thus, the laser beam is directed over the path, where the weld seam is formed, only once and not multiple times. The head 50 does not, for example, return to the start of the weld 15 and re-trace the same

weld path to form the weld 15. Accordingly, it is not inherent that Messler directs the laser beam over the path of a weld pool multiple times.

The Examiner considers a prolonged period of time being multiple times, see the paragraph beginning on page 10 of the Office Action and ending on page 11. Claims 13 recites directing a laser beam over a path of the weld pool multiple times. It is respectfully submitted that a prolonged period of time is not a reasonable interpretation of multiple times. If a laser beam is directed over a path of a weld pool for a prolonged period of time, the laser beam stays on the entire path of the weld pool for a period of time, which is one period of time and not multiple times.

Juret discloses a high energy-density beam 4 from a beam generator that welds two metal plates at their joint. The beam-generator 3 is fixed to a frame member 5 that is displaceable in the direction of the plane of the joint of the metal plates 1, 2 being welded. Juret discloses that the frame member 5 moves from left to right during welding of the plates. Juret fails to disclose or suggest directing the beam 4 over a path of a weld pool multiple times and thus does not cure the deficiencies of Messler.

The combination of Messler and Juret further fails to teach the step of obtaining a thermal image by collecting infrared radiation within a determined range of wavelengths from a weld and a pool of material. As noted, Messler teaches that a pyrometer 58 uses thermal radiation to image only an unsolidified weld melt 48 and a detector 55 uses inspection radiation 30 to image only a solidified weld seam 15. Thus, Messler does not teach obtaining a thermal image by collecting infrared

radiation within a determined range of wavelengths from a weld and a pool of material.

Juret does not cure the deficiencies of Messler, as Juret teaches thermal imaging only of a fused metal zone and not obtaining a thermal image of a weld and a pool of material as recited in claim 13. For these reasons, the combination of Messler and Juret does not teach the subject matter of claim 13. Accordingly, it is respectfully submitted that claim 13 patentably defines over the combination of Messler and Juret and is therefore allowable.

Claim 14 recites the step of obtaining a thermal image that includes, in its entirety, the weld pool that results in a weld. As noted, the combination of Messler and Juret does not teach this subject matter. Thus, it is respectfully submitted that claim 14 patentably defines over the combination of Messler and Juret and is therefore allowable.

Claims 15 and 20-21 depend from claim 1 and are allowable for at least the same reasons as claim 1 and for the specific limitations recited therein. Claims 26 and 29-30 depend from claim 13 and are allowable for at least the same reasons as claim 13 and for the specific limitations recited therein.

Claim 25 recites the step of heating the first and second pieces at their location of abutment to form a pool of material at the location of abutment which pool of material forms a weld between the pieces is performed by directing the laser beam over the path of the weld pool multiple times. Modifying occurs during directing of the laser beam over the path during at least one of said multiple times. Neither Messler nor Juret disclose or suggest this feature.

As noted, neither Messler nor Juret disclose or suggest directing a laser beam over the path of the weld pool multiple times. Since the combination of Messler and Juret does not teach the subject matter of claim 25 it is respectfully submitted that claim 25 patentably defines over the combination of Messler and Juret and is therefore allowable.

Claim 12 was rejected under 35 U.S.C. 103(a) as being unpatentable over Messler and Juret in view of U.S. Patent No. 4,083,223 to Hashimoto et al. Claims 7 and 18 were rejected under 35 U.S.C. 103(a) as being unpatentable over Messler and Juret in view of U.S. Patent Appln. No. 2002/01724410 to Shepard (hereafter "Shepard"). Claims 8 and 19 were rejected under 35 U.S.C. 103(a) as being unpatentable over Messler, Juret and Shepard in view of U.S. Patent No. 4,214,264 to Traub et al. Claims 24 and 28 were rejected under 35 U.S.C. 103(a) as being unpatentable over Messler and Juret in view of U.S. Patent No. 6,299,346 to Ish-Shalom et al. Claims 7-8, 12 and 28 depend from claim 1 and are allowable for at least the same reasons as claim 1 and for the specific limitations recited therein. Claims 18-19 and 24 depend from claim 13 and are allowable for at least the same reasons as claim 13 and for the specific limitations recited therein.

Claims 5-6, 16-17 and 31-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Messler and Juret in view of Shepard. Claims 5-6, 16-17 and 30-32 depend from claim 1 and are allowable for at least the same reasons as claim 1 and for the specific limitations recited therein.

Claim 33 recites the step of obtaining a plurality of thermal images as the weld is being formed and stopping the obtaining of any thermal images of the weld after

the weld is formed. The Examiner acknowledges that Messler and Juret do not teach obtaining a plurality of images and stopping the obtaining of any thermal images of a weld after the weld is formed. The Examiner asserts, however, that Shepard cures the deficiencies of Messler and Juret.

Shepard does not disclose stopping the obtaining of thermal images of the weld after the weld is formed. The Examiner argues that it is inherent that "Shepard would not take any images after the full image is reconstructed, and there is no need to take more images".

Under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to include the missing element if the missing element is "necessarily present" in the item described in the reference.

Continental Can Co. v. Monsanto Co., 948 F.2d 1264, 1268 (Fed. Cir. 1991).

"Necessarily present" for inherency means more than merely probably or possibly present. Trintec Industries, Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1295 (Fed. Cir. 2002).

The step of stopping the obtaining of any thermal images of a formed sample is not "necessarily present" in the device of Shepard. Quite the contrary, the abstract of Shepard discloses the use of an infrared camera to capture multiple, spatially different images of a sample that has been heated and allowed to cool to equilibrium temperature. This indicates that a thermal image is taken after a sample is formed and allowed to cool.

In the present application, the pool of material cools sufficiently to solidify and become the weld well before the first and second plastic pieces return to thermal

equilibrium. Thus, since there are no thermal images obtained after the weld is formed, there are no thermal images taken from the point at which the weld forms until the pieces return to thermal equilibrium. This is clearly in contrast to Shepard, where thermal images are obtained over the range of time during which the sample temperature returns to equilibrium (Paragraph 63). Accordingly, Shepard does not teach stopping the obtaining of thermal images of a weld after the weld is formed and therefore does not cure the deficiencies of Messler and Juret. Since the combination of Messler, Juret and Shepard does not teach the subject matter of claim 33, it is respectfully submitted that claim 33 patentably defines over the art of record and is therefore allowable.

Claim 34 recites the step of obtaining a plurality of thermal images as the weld is being formed and stopping the obtaining of any thermal images of the weld after the weld is formed. The Examiner acknowledges that Messler and Juret do not teach obtaining a plurality of images and stopping the obtaining of any thermal images of a weld after the weld is formed. The Examiner asserts, however, that Shepard cures the deficiencies of Messler and Juret. As noted, the combination of Messler, Juret and Shepard does not teach the step of obtaining a plurality of thermal images as the weld is being formed and stopping the obtaining of any thermal images of the weld after the weld is formed. Accordingly, it is respectfully submitted that claim 34 patentably defines over the combination of Messler, Juret and Shepard and is therefore allowable.

Claim 27 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Messler and Juret in view of U.S. Patent No. 7,044,634 to Sandvoss. Claim 27

depends from claim 1 and is allowable for at least the same reasons as claim 1 and for the specific limitations recited therein.


Claim 35 recites that the path is a closed-curved shape, and wherein the step of heating the first and second pieces at their location of abutment to form a pool of material at the location of abutment which pool of material forms a weld between the pieces is performed by directing the laser beam around the path of the weld pool multiple times; and the modifying occurs during directing of the laser beam around the path during at least one of the multiple times. None of the cited references disclose or suggest this feature. In fact, the Office Action fails to cite any reference or even any reason to reject claim 35. Therefore, claim 35 is allowable.

Claim 36 recites that the path is a closed-curved shape, and wherein the step of heating the first and second plastic pieces at their location of abutment is performed by directing the laser beam around the path of a weld pool multiple times to form a pool of material at their location of abutment which pool of material forms a weld between the pieces. None of the cited references disclose or suggest this feature. In fact, the Office Action fails to cite any reference or even any reason to reject claim 36. Therefore, claim 36 is allowable.

In view of the foregoing, it is respectfully requested that the amendment be entered and the application allowed. It is believed that the amendment introduces no new issues and requires no additional searching by the Examiner.

Please charge any deficiency or credit any overpayment in the fees for this
amendment to our Deposit Account No. 20-0090.

Respectfully submitted,


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